

TECHNICAL ANALYSIS

LBA #9
Genwal Coal Company
Crandall Canyon Mine
ACT/015/032 #3

September 23, 1994

SYNOPSIS

Genwal originally submitted its application for adding the LBA lease on December 1, 1993. On May 9, June 2, July 6, July 11, July 12, 1994, and September 22, 1994 Genwal responded to reviews of its plan to add lease UTU-68082 to its permit area. Many issues identified in the prior reviews have been resolved. Some deficiencies with the plan remain, but these have been required to be corrected by stipulation.

The LBA #9 lease will be mined as an extension of current underground operations. No surface facilities or disturbance are planned with this additional lease. The following analysis focuses primarily on adding this lease to the permit area. Some areas of the existing Mining and Reclamation Plan (MRP) were also reviewed (primarily hydrology) in conjunction with this application to determine how well the application meshes with the current plan. Discussions of surface facilities, while not part of the LBA Application per se, are included to assist the Operator in coordinating the application to the MRP.

ANALYSIS

R645-301-112

Identification of Interests

Discussion:

The Applicant and Operator are Genwal Coal Company, and the resident agent is Larry Johnson. The Intermountain Power Agency ("IPA") and Nevada Electric Investment Corporation ("NEICO"), as joint owners, will pay the abandoned mine reclamation fee. The revision shows the names of officers and directors of Genwal, IPA, NEICO, and Nevada Power and the dates these officers and directors assumed their positions. Nevada Power Company owns all of NEICO's stock.

The application says that IPA is currently engaged in the reclamation of the Horse Canyon Mine. NEICO holds permit ACT/007/012 for an area south of Wellington. The application includes these mines' MSHA numbers and their issuance dates.

The legal owners of areas to be affected by surface operations and facilities are: the U.S. Forest Service ("USFS"), State of Utah, and Genwal Coal Company.

The application shows holders of leasehold interests, including Genwal and the heirs of John Sanders. The coal is owned by the U. S. government and the State of Utah.

Other information required by this regulation is in the application.

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R645-301-113

Violation Information

Discussion:

The application says that neither the Applicant nor any subsidiary, affiliate, or persons controlled by or under common control with the Applicant has had a federal or state mining permit suspended or revoked in the last five years. They have not forfeited a mining bond or similar security deposited in lieu of bond, and there are no unabated cessation orders or air and water quality violation notices received prior to the date of the application. The application contains lists of violation notices received by Genwal for the Crandall Canyon Mine, IPA for the Horse Canyon Mine, and Castle Valley Resources for the Wellington Preparation Plant.

R645-301-114

Right-of-Entry

Discussion:

The application includes right-of-entry information for federal leases SL062648, U-54762, and UTU-68082 and for State leases ML-21568 and ML-21569. It also contains copies of the special use permits and of the warranty deed for the property that Genwal purchased from Mountain Coal.

R645-301-115

R645-301-117

R645-301-123

**Unsuitability Claims
Insurance, Proof of Publication
Notarized Signature**

Discussion:

The application says that available information is that the proposed permit area is not within an area designated as unsuitable for underground mining activities. The Manti LaSal National Forest applied unsuitability criteria in the Environmental Assessment ("EA") and recommended approval.

The submittal includes a copy of an insurance certificate showing that insurance coverage would expire January 1, 1995. The insurance certificate appears to meet Division requirements.

On June 14, 1994, the Division received a copy of the newspaper advertisement of the application for permit revision. A copy of this advertisement has been included in the application.

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The application contains the notarized statement of a responsible official of the Applicant that the information in the application is true and correct to the best of the official's information and belief.

R645-301-120

Clear, Concise, Current

Discussion:

Hydrologic design information that was provided in the original MRP has been recopied and is submitted as Appendix 7 of the LBA application. As a result of the recopying process some of the information has become illegible. While not critical to the LBA this design information is important for keeping the entire plan clear and consistent.

The Operator should provide clear legible design information for the hydrologic appendices.

Deficiencies:

1. The Operator must provide clear legible design information in the hydrology appendices.

R645-301-321

Vegetation Information

Discussion:

The LBA revision does not require surface disturbance; therefore, the amount of vegetation information required is limited. Lease stipulation seven requires that the lessee establish a monitoring system to locate, measure, and quantify the progressive and final effects of underground mining activities on the topographic surface, underground and surface hydrology and vegetation. The monitoring system shall utilize techniques which will provide a continuing record of change over time and an analytical method for location and measurement of a number of points over the lease area.

Genwal has committed to take aerial color infrared photographs every five years beginning in 1995 to monitor the effects of underground mining on vegetation.

R645-301-322
R645-301-333

**Wildlife and Threatened or Endangered Species Information
Wildlife Protection**

Discussion:

The revision contains a copy of a memorandum from Scott Richardson of Wildlife Resources that contains the results of a 1993 helicopter raptor survey of the new lease areas and adjacent areas. Mr. Richardson was not able to locate two previously identified golden eagle nests within the current and proposed permit area, and no other nests were found in the permit area. Several nests were found in adjacent areas, however. Based on this information, there were no cliff-nesting raptor nests that could be damaged by subsidence.

Genwal's application commits to helicopter monitoring of the golden eagle nest in Crandall Canyon every three years or on request of the Fish and Wildlife Service or Wildlife Resources. This nest was inactive for several years, and, as mentioned above, it could not be found in the 1993 survey. Genwal second mined the area under this nest in 1992. Because the area has been second mined and because the nest has been inactive and may no longer be present, it should not be necessary to look for this specific nest after the next survey. It would be more beneficial to check for new nesting activity in areas that will be mined in the future and that contain potential cliff-nesting raptor habitat.

There is a potential for tree-nesting raptors to occur in the area. The application commits to a plan presented by Wildlife Resources in a letter dated April 28, 1993. This letter says that if annual subsidence monitoring detects an area that is actively subsiding, the area should be surveyed for tree-nesting raptors. Measures should be implemented to protect any nest sites from destruction during the nesting season.

A letter from Wildlife Resources that was in Appendix 13-3 of the old plan has been included in the application. It says that certain areas, particularly the state leases, were surveyed for cliff-nesting raptors and that the habitat is of poor quality for these species.

Other effects on wildlife are expected to be minimal. Wildlife Resources' primary concern is the potential loss of water sources, and Genwal's application addresses this concern. If it is proven that the flow of any seep or spring has been reduced by 50% or more, Genwal will notify the and the Divisions of Wildlife Resources and Oil, Gas and Mining and begin working on an acceptable mitigation plan involving the use of guzzlers.

The EA contains a biological assessment/evaluation that discusses several endangered and sensitive species that could occur in the area. It found that there will be no effect on most of the species from leasing and mining the coal, but goshawks could be affected through loss of water sources. There are no threatened or endangered plant species known for the area according to information from Bob Thompson of the Manti LaSal USFS.

R645-301-500

Engineering

Discussion:

Genwal Coal Company proposes to add federal coal leases to the Crandall Canyon Mine. New subsidence monitoring stations are the only surface facilities to be constructed. The major engineering concern associated with the new leases is subsidence which must be confined to the permit area. Renewable resources must also be protected. There are no structures or utilities that could be affected by subsidence.

Coal recovery is a minor issue associated with the addition of new coal leases. The Division of Oil, Gas and Mining, ("Division") generally does not do a detailed study involving coal conservation, but relies on studies and recommendations of other government agencies.

Coal Recovery Proposal

The Bureau of Land Management ("BLM") and the Utah State Division of Natural Resources governs the conservation and royalty payments of the coal located within the Applicant's proposed permit boundary. To ensure proper resource conservation, the mine plans must be approved by appropriate state and federal agencies.

In the proposed lease area, only the Hiawatha seam is considered minable. According to the available information, all the coal in the lease area appears to be minable. The Operator plans to extract as much coal as practical. During the course of mining, more information about the coal will be discovered. The new information may require the Operator to adjust the mine plan.

Some coal must be left in place to provide stream protection, buffer zones and barrier pillars. Perennial streams in the lease area must be protected from subsidence. The protection plan calls for no secondary mining in the stream buffer zones. The barrier pillars are needed to prevent material related damage from occurring outside the permit area.

Subsidence Monitoring and Control Summary

There are no structures or utility corridors in the lease areas. If subsidence damage does occur, it will be limited to natural renewable resources. Streams, forage and wildlife habitat could be effected. The creeks within the lease area include Crandall Creek, Blind Canyon Creek and the left fork of Horse Canyon.

The streams will be protected by stream buffer zones. In the stream buffer zones, secondary mining will not be allowed. The pillars in the buffer zones are of sufficient size to prevent subsidence damage. The buffer zones are shown on Plate 5-2.

If it can be proven that mining related activities decrease flow in seeps and springs by fifty percent, the Operator will mitigate the damage. The mitigation will consist of installing guzzlers and other devices to store water.

Loss of grazing areas and wildlife habitat will be mitigated. The mitigation will usually consist of financial compensation.

The key to preventing subsidence damage from occurring outside the permit and stream buffer zones is to determine the angle of draw. The Operator has estimated the angle of draw to be 20 degrees based on studies by the U.S. Bureau of Mines ("USBM") and field observation of other mines in the area.

Subsidence will be monitored with aerial surveys designed by the U.S. Forest Service. The area within the 20 degree angle of draw will be flown before mining. Once mining begins, the affected area will be flown annually. When no subsidence has been detected at a point for two years, the point will be monitored every two years. If no movement has occurred on a point monitored biannually for three consecutive surveys, the monitoring will be done every five years.

As required within the approved 1988 MRP, a visual quarterly subsidence/escarpment failure survey has been completed for two years where mining has taken place beneath escarpment areas visible from Huntington and Crandall Canyon for two years after development mining within those areas. There are no further plans to monitor escarpments not visible from Huntington or Crandall Canyons.

The subsidence/escarpment survey results to date were recorded and submitted to the appropriate regulatory authority. No escarpment failure has occurred.

The 20 degree angle of draw used to project the outer limits of subsidence and to protect perennial streams within the mining area was supported by two documents which show this angle of draw to be adequate.

- 1) A BLM letter to the Utah State Division of Oil, Gas and Mining dated December 11, 1981 states that the possible draw angle should be in the 15 to 20 degree range. This conclusion was based on previous history of subsidence occurring in the Wasatch Plateau/Book Cliff area. This letter is identified as Appendix 5-5.

2) Appendix 5-6 is a report, "Preliminary Study of Potential Subsidence Over the Genwal Coal Mine." This report includes subsidence calculations, subsidence history, analysis, and charts with final conclusions showing that there may be a maximum subsidence result of 3 to 4 inches within the boundaries of the leased area. The draw angle over the intact coal is expected to be in the order of 20 degrees.

While the 20 degree angle of draw is considered adequate to protect the renewable resources of the area, the Forest Service requested an additional measure of protection for the perennial streams. An additional 25 feet each side of the perennial stream channel was added to the buffer zone in areas above the forks of Crandall Canyon and the south fork of Horse Canyon. In areas below the forks of Crandall Canyon an additional buffer of 50 feet each side of the stream channel was added.

Analysis of Subsidence Monitoring and Control

The two main issues involving subsidence control are confining subsidence to the permit area and preventing damage to the streams in the permit area. The Operator's maps show that subsidence is not projected to occur outside the permit boundaries.

Stream damage will be reduced by stream buffer zones. No secondary mining will be allowed in the buffer zones. The buffer zones are shown on Plate 5-2.

The Operator states in Chapter 5 that the angle of draw will be 20 degrees. The two references cited for the 20 degree angle of draw are a letter from the BLM and a subsidence study conducted at the Genwal Mine. The BLM states that a 30 degree angle of draw is very high for this region. Angles of this magnitude come in part from observations of mining in the eastern United States and in part from the National Coal Board in the United Kingdom. Documented subsidence data from mining areas in the Wasatch Plateau show draw angles ranging from 15 to 20 degrees. This data came from mining companies and two independent studies from the Bureau of Mines.

A Terra Tek study commissioned by Genwal quotes the 1988 Bureau of Mines Information Circular 9194 by Allgaier which was conducted at the nearby Deer Creek Mine. The Terra Tek report states, "It is reasonable to assume that the inferences drawn from the USBM study could be applicable to the Genwal Mine as well".

FINDINGS

Usually the Division does not investigate the coal recovery program. The Division instead relies on the studies of other state and federal agencies. The main document used by the Division to determine resource conservation is the Resource Recovery and Protection Plan ("R2P2"). The BLM and the USFS have reviewed and accepted the R2P2.

The surface and mineral management agencies believe that the 20 degree angle of draw is considered adequate for protecting most of the renewable resources in the area. The perennial streams will be protected by an additional amount ranging from 25' to 50' as shown on plate 5-2. These agencies believe that increasing the draw angle would not improve protection to human safety and the environment. Increasing the draw angle would only decrease the amount of coal that can be recovered.

The angle of draw defines the area where mining activities have resulted in measurable ground movement. The angle of draw varies with the local geology and surveying methods. While all subsidence damage is the result of surface movement, not all surface movement results cause damage. While surface movement in nearby mines has resulted in angles of draw greater than 20 degrees the damage has been confined to areas above the panels. Increasing the draw angle may not result in any significant protection. The Division has agreed to accept 20 degrees as the angle of draw for the LBA.

R645-301-514.330

Inspections

Discussion:

The Operator references Section 5.14. This section includes a form for the Operator's inspections. On page 5-1 through 5-3, the Operator has included measures for inspection reporting and includes inspection report forms.

The Operator indicates that all inspections, except those described under **R645-301-514.330**, will be conducted by a professional registered engineer or specialist under the direction of an engineer.

Part A was amended to include reference to meeting the requirements of **R645-301-514**. The quarterly inspection sheet was amended to include piezometer readings and note any appearance of instability structural weakness or hazardous conditions. The Operator has adequately addressed this section.

R645-301-612

Certification

Discussion:

Locations of test borings DH-2 through DH-7, drilled 1989 - 1991, are shown on Plates 5-2, 6-3, and 7-7. Plate 5-2 also shows MW-4 and DH-1, borings drilled upwards from inside the mine. Plates 5-2, 6-3, and 7-7 are certified. Elevations of borings DH-2 (1989), DH-3, DH-4, DH-5, DH-6, and DH-7 are indicated by the topographic contours on

Plate 7-7. Elevations of bore hole collars are on the headings of the bore hole logs in Appendix 6-5; the logs were not certified at the time they were created and Genwal cannot retroactively certify these data. The required elevation information is in the proposed plan in a usable format. Elevations of the Hiawatha coal seam are on Plate 6-7, which is certified.

Depth of the Hiawatha coal seam (isopach of overlying strata) is shown on Plate 6-6, which is certified. Thickness of the Hiawatha, Blind Canyon, and Bear Canyon seams are on certified Plates 6-3, 6-4, and 6-5. Thickness and nature of each stratum of the overburden and interburden is on uncertified logs and cross sections in Appendices 6-1 and 6-6. Thickness and nature of underlying strata are on uncertified logs of monitoring wells in Appendix 7-46.

Crop line of the Hiawatha coal seam is shown on certified map Plate 6-3. Crop line and strike and dip, shown by structural contour lines, are on certified Map 6-7.

**R645-301-622.100 Elevations and Locations of Test Borings
and Core Samplings**

Discussion:

Stratigraphic sections and cross sections are in Appendices 6-1, 6-4, and 6-5. Drill hole results and cross sections are in Appendix 6-5. Coal seam isopachs are on Plates 6-3, 6-4, and 6-5 and the overburden isopach is on Plate 6-6. Structure on the top of the Hiawatha is on Plate 6-7. Locations for proposed in-mine up-drilled borings in State lease ML-21568 are on Plate 5-2, along with locations of existing bore holes and ground water monitoring wells.

Lithofacies of the Blackhawk Formation are shown in the stratigraphic sections "A" and "B" in Appendix 6-1. IMDH-1 (also labeled MW-4up and drilled at the same location as MW-4 but drilled up into the mine roof) and DH-7, both in lease ML-21569, provide useful information in determining the depth, nature, and thickness of the coal seams, rider seams, and overburden and interburden for the permit area. Logs from bore holes IMDH-1 and DH-2 through DH-7 are in Appendix 6-5 and provide a great deal of information on the coal and strata overlying the Hiawatha seam. The location of drill hole DH-7 (NVP-7) is on several maps, and the location of IMDH-1 (MW-4up) is shown on map 5-2.

Logs and a cross section of up-drilled holes DH-1 and DH-2, drilled in 1985, are in Appendix 6-5. Locations of these two drill holes are on Plate 5-2 and locations of measured sections "A" and "B" (Appendix 6-1) are on Plate 6-1.

Locations of test borings DH-2 through DH-7 (NVP-2 through NVP-7), drilled in 1989 to 1991, are shown on Plates 5-2 and 6-3. Elevations of borings DH-2 (NVP-2), DH-3, DH-4, DH-5, DH-6, and DH-7 are shown on Plates 5-2 and 7-7 and are on the headings of the logs in Appendix 6-5.

Thicknesses for the Hiawatha and Blind Canyon seams are marked at bore hole GS-CLB-1 on Plates 6-3 and 6-4, but the bore hole location and thickness for Bear Canyon are not on Plate 6-5. Genwal's data for this bore hole, obtained from Radian Corp, indicate the Bear Canyon seam is not present at this bore hole.

Depth of the Hiawatha coal seam (isopach of overlying strata) is shown on Plate 6-6. Thickness of the Hiawatha, Blind Canyon, and Bear Canyon seams are on Plates 6-3, 6-4, and 6-5. Thickness and nature of each stratum of the overburden and interburden are on the logs and cross sections in Appendices 6-1 and 6-6. Thickness and nature of underlying strata are on logs of monitoring wells in Appendix 7-46.

**R645-301-622.200 Coal Seams, Overburden, Stratum Below
Coal Seams**

Discussion:

Additional technical information has been submitted to determine the nature, depth, and thickness of the coal seams, rider seams, overburden, and interburden in the permit area based on drilling completed to date. Plate 6-3 shows the Hiawatha seam isopach, Plate 6-7 shows the structure of the Hiawatha seam. The Hiawatha seam is the only coal seam in the permit area that is of minable thickness. There are no reserves considered minable or recoverable in the upper seams. Plates 6-4 and 6-5 indicate the Bear and Blind Canyon seams are not economically recoverable. Plate 6-6 shows the thickness of overburden above the Hiawatha seam.

Stratigraphic sections and logs in Appendices 6-1, 6-4, and 6-5 show thickness and nature of the overburden. Five monitoring wells have been drilled underground. Logs of those wells that show the nature and thickness of strata underlying the coal seam to be mined are in Appendix 7-46.

**R645-301-624.300 Samples Collected and Analyzed from Test
 Borings or Drill Cores**

Discussion:

Logs of drill holes showing lithologic characteristics are found in Appendix 6-5. No occurrences of ground water are noted. Pyrite, alkalinity, and clay content data are in Appendix 6-2. Pyrite and alkalinity of strata immediately above and below the Hiawatha seam are summarized on page 6-9. Sample analyses in Appendix 6-2 were provided by Mr. Wollen, a former Operator of the Genwal property (page 6-5). Additional samples have been taken from the mine floor and roof in lease ML-21569 to fulfill the commitment on page 6-9 in the current and proposed plans. The results of analyses for acid- and toxic-forming materials have been reported to DOGM and have been added to Appendix 6-2 in the proposed plan.

Mr. Wollen, a former Operator of the Crandall Canyon property, collected rock and coal samples and had them analyzed. The analysis reports in Appendix 6-2 were supplied by Mr. Wollen. The locations at which samples were collected are not known. For the coal, total sulfur is 0.58% and acid-base potential is -11 tons CaCO_3 /1000 tons (page 6-9). Stratigraphic sections and drilling do not show any clays or soft rock immediately above or below the seam to be mined (page 6-10). Additional coal samples are to be taken in Lease ML-21569 to supplement the information provided by Mr. Wollen.

R645-301-712 Certification of Cross Sections, Maps and Plans

Discussion:

Locations of seeps and springs are shown on Plate 7-12. Surface water bodies such as streams, lakes, and ponds, constructed or natural drains, and irrigation ditches within the proposed permit and adjacent areas are shown on Plates 7-12, 7-14, 7-15, 7-16 and other plates in the proposed plan that are based on USGS topographic maps.

Elevations and locations of spring monitoring stations used to gather baseline data on water quality and quantity in preparation of the application are shown on Plate 7-12.

Elevations and locations of stream monitoring stations used to gather baseline data on water quality and quantity in preparation of the application are shown on Plate 7-16.

Locations of water monitoring wells are on Plate 7-13. Location of the water supply well MW-1 is on Plate 5-2. Depths of wells are in logs in Appendix 7-46.

Locations and elevations of springs to be used for water monitoring during coal mining and reclamation operations are on Plate 7-12. All of the plates discussed above are certified.

R645-301-722

Cross Sections and Maps

Discussion:

Figures 7-1 through 7-12 and Plates 7-1 through 7-17 depict existing surface and ground water occurrences in and adjacent to the Crandall Canyon Mine permit area. These also illustrate the topography, streams, springs, wells, water monitoring locations, and other hydrologic design information pertinent to the Crandall Canyon Mine.

Location and extent of subsurface water within the proposed permit or adjacent areas are shown on the potentiometric surface map, Plate 7-13. The area covered by Plate 7-13 does not include Little Bear Spring, but the location of Little Bear Spring is on Plates 7-12, 7-14, and 7-15. Some idea of the areal and vertical distribution of perched aquifers is inferred from the seep and spring locations on Plate 7-12. Seasonal differences of head in the regional aquifer are not indicated by the data.

Locations of streams, lakes, ponds, springs, drains, and irrigation ditches within the proposed permit and adjacent areas are shown on USGS topographic maps used as the bases for several maps in the proposed plan, including Plates 7-12, 7-14, 7-15, and 7-16.

Elevations and locations of monitoring stations used to gather baseline data on quality and quantity of ground and surface water are on Plates 7-12 and 7-16.

Locations of water monitoring wells are on Plate 7-13. Location of the water supply well MW-1 is on Plate 5-2. Depths of wells are on logs in Appendix 7-46.

Maps or cross sections showing contours of the land surface configuration of the disturbed area are not in the proposed plan, however, aerial photographs taken in 1980 and Plates 5-12 and 5-13, provide an approximation of the original configuration.

Locations of leases are shown on Plate 1-1 plus several maps in Chapters Six and Seven.

R645-301-724.100

Baseline Groundwater Information

Discussion:

A few of the seeps and springs have been developed for beneficial use. No water wells used for consumption by animals or humans other than MW-1 are known to exist within the study area of the spring inventory. Hence, only minor groundwater development has occurred in the past within the mine plan or adjacent areas. Appendix 7-1 lists groundwater rights in and adjacent to the permit area and locations are on Plate 7-14.

Current underground use of water for the mine equipment is 14.3 gpm. Infiltration along the mine floor and sumps is approximately 10 gpm and evaporation due to mine ventilation equals 50 to 60 gpm. Coal moisture content accounts for approximately 68.5 gpm. The combined total equals approximately 150 gpm.

Natural mine inflow accounts for less than 400,000 gallons per year (less than 1 gpm) of the water used in the mine, the majority occurring in the old mine workings. Due to the dryness of the mine, water from the surface and from a water supply well is being pumped into the mine. Monitoring well MW-1 was installed in 1987. This well currently supplies water for in-mine use at a rate of less than 1 gpm. Pumping from Crandall Creek into the mine workings totals no more than 75 gpm. It is estimated that in 1993 approximately 7.6 million gallons of water (14.3 gpm) were used in the mine (Appendix 7-21).

Little Bear Spring in Little Bear Canyon is located roughly two miles southeast of the mine portal. This spring is an important source of water for the Castle Valley Special Services District and that organization has expressed concerns in the past about potential impacts of mining on the spring. These concerns are discussed in the PHC (Appendix 7-15), but this spring is not mentioned in Section 7.24.1. Little Bear Spring will probably be unaffected by mine operations. The spring is downgradient of the underground workings based on the potentiometric surface on Plate 7-13, but it is not shown on that map. The spring location is on Plates 7-12, 7-14, 7-15, and 7-16, but has not been included in Genwal's seep and spring surveys because of its distance from the permit area boundary.

Specific conductance, pH, temperature, use, and flow data for monitored seeps and springs are in Appendices 7-16 through 7-19 and discussed on pages 7-12 through 7-13. Along with TDS (or specific conductance corrected to 25° C) and pH, analysis of groundwater for total iron and total manganese is required by R645-301-724.100 and 731.211. Tables 7-4 and 7-5 in the proposed plan include both total and dissolved iron and total manganese.

Laboratory reports in Appendix 7-20 show that in the past analysis has been done for dissolved iron part of the time, for total iron part of the time, and for both total and dissolved iron part of the time. Whether analysis was for total or dissolved iron is not indicated on many reports. The laboratory reports rarely identify analysis for manganese as being for total or dissolved forms. Use, flow, temperature, pH, and specific conductance (at 25° C) are included in Appendices 7-16 through 7-20 and in the summaries on pages 7-22. Iron and manganese, either total or dissolved, is not included in the summary on page 7-22.

R645-301-724.200

Baseline Surface Water Information

Discussion:

Appendix 7-1 lists water rights in and adjacent to the permit area. Locations of surface water rights are on Plate 7-15. Surface water rights are summarized in Table 7-6. The name and location of streams are on the USGS topographic map used as a base for several plates in the proposed plan. The only impoundment and discharge into any surface-water body in the proposed permit and adjacent areas is the sediment pond and its discharge structures shown on Plate 7-5a.

Flow measurements from the USGS gauging station at the mouth of Crandall Canyon from October 1979 to September 1984 are in Appendix 7-2. Appendix 7-23 contains flume measurements for Crandall Canyon from May 1988 to October 1992 and for Blind Canyon from July 1991 to October 1991. Instantaneous flow data in Appendix 7-23 for Blind, Horse, and the north end of Crandall Canyons were collected in 1991 at locations shown on Plate 7-16. Results of an instantaneous flow survey by IES of Horse, No Name, Blind, and Crandall Canyons in September 1992 are in Appendix 7-23. Plate 7-16 shows perennial stream reaches based on these flow observations.

Horse Creek is shown on Plate 7-16 as perennial to just above the main fork. Instantaneous flow data for Horse Canyon in 1991 recorded no flow in the north fork and in the uppermost 1/2 mile of the south fork. The instantaneous flow observation in 1992 found the south fork to be dry and the north fork to be dry approximately 340 feet upstream of where the forks join. Despite these data, Genwal has shown the lower half of Horse Creek as perennial, as it was on older versions of this map, to avoid initiating a new EA by the USFS.

On Plate 7-16 Blind Creek is shown to be perennial in the lowermost 3/4 to 1 mile of the canyon, from Huntington Creek up to above station B-1. The Blind Canyon flume data show the stream flowed from July 1991 until the flume froze in September 1991, but the stream was dry for most of September and all of October in 1992. Instantaneous flow observation also indicate Blind Canyon was dry in September 1992. Designating the

lowermost stretch of the stream as perennial appears to be a cautious approach.

The two forks of Crandall Creek are shown on Plate 7-16 to be perennial for all but the uppermost reaches. Instantaneous flow observations in 1991 found that only the uppermost reaches of both forks were dry, down to stations CS-4 and CS-6 in the south fork and down to station CN-5 in the north fork. Instantaneous flow observations in September 1992 found the north fork was flowing up to station CN-4, but flow in the south fork was described as "intermittent". Genwal intends to continue monitoring to determine additional reaches of these forks can be designated as ephemeral or intermittent.

Genwal has maintained two 36-inch Parshall flumes in Crandall Creek, just above and below the surface facilities, since 1988. For the period from May 1988 to October 1992 reported in Appendix 7-23, flows through the lower flume are consistently lower than flows from the upper flume. The lower flume was reported to be intermittently dry in May 1992 while the upper flume recorded 0.82 cfs to 1.12 cfs: the upper flume froze but never indicated the stream to be dry during the time period covered. Maximum flow recorded at the upper flume was 26.79 cfs on May 4, 1988 but the maximum at the lower flume was 15.35 cfs on May 13, 1988 (21.01 cfs at upper flume). Genwal has determined that the cause of the discrepancy between flows recorded at the two flumes was that the floats were turning the drums of the Steven recorders in opposite directions. Genwal is reassessing the data for this period and has committed to submit correct flow data by December 1, 1994.

Genwal has historically pumped water from Crandall Creek for use underground. Genwal has committed to determine, in consultation with the USFS, the appropriate baseline stream flows that should be maintained in Crandall Creek during pumping operations. This determination will be completed by August 31, 1995. Including Utah Division of Wildlife Resources in the determination process would be appropriate because of the sport fishery potential, beaver population, and other wildlife uses of Crandall Creek.

Indian Creek is marked on Plate 7-16 as being perennial up to an elevation of roughly 8950 ft. Genwal personnel have regularly observed the creek to be dry above 9120 ft in October and November. USFS instantaneous flow data for Indian Creek from 1970 to 1977 are in Appendix 7-44. Genwal has installed a flume in Indian Creek but data from that flume are not presented in the proposed plan.

Blind Canyon is the location of a study, being done by the USFS and partially financed by Genwal, of effects of retreat-mining induced subsidence on watershed erosion and stream flow. The study has the objectives of quantifying changes in stream channel profiles and changes in channel features such as erosion caused by subsidence from retreat-mining. Methods outlined in the proposal in Appendix 7-25 involve establishing cross sections and stream profiles, surveying morphometric features, and assessing streambank

stability and landslides. A timetable for the research and mining is in Appendix 7-26 and related information is in Appendices 7-27 through 7-39. An interim report is due from the USFS by September 1994 and a final report by September 1995.

Because subsidence induced increases of sediment load could impact USFS lands and waters outside the permit boundary, Genwal has committed to provide off-site erosion control measures for USFS lands to offset potential damage. An agreement whereby Genwal donates \$15,000 to the Manti-LaSal National Forest to fund graveling of a road in Nuck Woodward Canyon is in Appendix 7-49. In addition, Genwal commits to mitigate unexpected adverse effects to Blind Canyon Creek and the fishery in Huntington Creek.

Horse Canyon is hydraulically upgradient of the proposed mine, and most of the perennial reach is outside the LBA lease. Proposed mine plans do not indicate retreat mining beneath the stream or adjacent buffer zones in the LBA lease. Mining has already occurred beneath Blind and Crandall Canyons and under the south fork of Horse Canyon, and retreat-mining under the uppermost reaches.

There are no water quality data for Horse Canyon in the proposed plan. Genwal commits to monitor Horse Canyon quarterly beginning in the Fall quarter, 1994, with water samples collected from station H-1 and analyzed according to Table 7-8. Instantaneous flow measurements will be made at stations H-1, HS-1, and HN-1. Monitoring will continue for three years then be reevaluated. Further retreat-mining under the Horse Canyon drainage is not proposed until 1996 (Plate 5-2). This provides time to characterize baseline conditions in Horse Canyon. Results of the Blind Canyon study or other information may justify modification of the monitoring plan in the future.

Surface water quality data collected from Crandall and Blind Creeks by Genwal are in Appendix 7-3. Appendix 7-42 contains water quality data on the seeps and springs. Appendix 7-43, which contained field water quality measurements from 1989 - 1991 for Crandall and Blind Canyons, has been removed from the proposed plan, but more complete data are available in the annual reports.

USFS water quality data for Indian Creek are summarized in Appendix 7-45. Water samples were analyzed for all parameters required by R645-301-724 except for total manganese, but analysis was done for dissolved manganese. Total manganese is included in the proposed monitoring plan. Total manganese in area streams is typically very low, often below detection limits. Analysis of the sample from the west flank of East Mountain (Appendix 7-48) did not detect total manganese. Analysis for this parameter in Indian Creek will be ongoing on a quarterly schedule. Mining beneath the west slopes of East Mountain is not planned until 1999, which will provide adequate time to establish a more extensive baseline for total manganese.

R645-301-728 Probable Hydrologic Consequences Determination ("PHC")

Discussion:

The PHC is in Appendix 7-15.

Impacts to the regional aquifer (including the Little Bear Spring) and to perched aquifers and related seeps and springs, water consumption from mining, interception of surface water due to subsidence, seepage from the mine, and pumping of water from Crandall Creek are water quantity impacts that are considered. Potential water quality impacts are increased sediment loading, fugitive dust, oil and grease, discharge of mine water to the surface, acid- and toxic-forming materials, and flooding and streamflow alteration.

Adverse impacts to the hydrologic balance are expected to be minimal. Only limited waste rock is produced at the mine, and acid- and toxic-forming materials are not produced. Sediment yield from the disturbed area is expected to increase. Impacts to surface water quality are expected to be minimal because the sediment controls are in place and maintained to minimize sediment loading to drainages, discharges from the sediment pond are in accordance with the requirements of the UPDES permit, historical data do not indicate mine related impacts to the hydrology of the area, and water monitoring will continue so any problems noted can be mitigated. It is unlikely that ground water quality or quantity will be affected by the underground mining operation.

Adequately sized diversions, sediment pond, and velocity control structures reduce the potential for flooding. The toe of the sediment pond has been armored with rip-rap to protect it against Crandall Creek, and the design meets criteria to protect the structure from predicted flows.

Water is pumped from Crandall Creek for use in the mine and surface water availability could be impacted by excessive pumping of water from Crandall Creek. Genwal has committed not to pump at a rate that will cause stream flow to fall below the minimum required rate, and to determine that minimum rate by August 31, 1995.

The mine workings intercept only a small amount of ground water. The potentiometric surface of the regional Blackhawk-Starpoint aquifer lies 50 to 60 feet below the top of the Starpoint Sandstone, which is below the Hiawatha coal. Dewatering of this aquifer and loss of flow at Little Bear Spring is not likely.

There is some potential for impact to seeps and springs through subsidence. Seeps and springs and water rights have been identified. Genwal is monitoring flow rates and

quality for the water rights within and adjacent to the current mine permit area. An alternate water source plan has been developed in the event any water rights or springs/seeps are adversely affected by the mining operation or reclamation activities.

Ground Water

In Section 7.24.1, page 7-18, the Operator states that a smaller number of seeps and springs drain the perched aquifers in the Blackhawk formation and lie approximately 420 or more feet above the potentiometric surface of the regional Blackhawk-Starpoint aquifer. "With no direct communication with the underlying regional aquifer these water sources should not be affected by mine de-watering".

The existing plan indicates the mine de-watering is the primary mechanism by which groundwater system could be impacted. The mined seam is located above the Starpoint aquifer piezometric surface, and to date has received a few short large volume flows requiring three discharges from the mine. The springs monitored cover the proposed areal extent of the mine and are located in each of the lithologic units above the mine. The Operator feels that the upper strata of the Blackhawk is primarily aquicludes.

Information presented by the Operator supports the conclusion that these seeps and springs are not connected to the regional aquifer and that the regional aquifer is not likely to be affected by mining. However, should the perched aquifers above the mine be dewatered they are not likely to significantly impact water quantity in the regional aquifer based on the following information presented by the Operator:

1. The perched aquifers lie 420 feet above the potentiometric surface or approximately 240' above the base of the Hiawatha coal seam. A relative elevation of approximately 8040' to 9200' at the north west end of the lease area.
2. The Blackhawk outcrops downdip of the mine site and outside of the permit area at approximately 7750' to 8800'. The Operator estimates the perched aquifers at the top of the Blackhawk are at an elevation of 8,720' (page 7-18). Little mine water inflow has occurred to date. The mined coal lies between 7850' at the mine entrance and 9050' up dip from the main entry within the lease areas.
3. The average horizontal hydraulic conductivity of the Blackhawk at Trail Mountain is 1.3×10^{-2} . The average vertical conductivity is 3.8×10^{-3} feet per day. This rate is said to be representative of the Genwal lease area and indicate that little water moves beyond the perched zones to recharge the

regional aquifer. A significant aquiclude is believed to be present above the mine. Recharge of the regional aquifer is driven by fault fracture systems which have not been highly visible according to the Operator's experience.

The Operator states that the wells indicate the potentiometric surface lies 50 to 60 feet below the top of the Starpoint Sandstone, and the Hiawatha seam lies at the base of the Blackhawk overlying the Starpoint. The Operator submitted confidential drill hole information from their exploration program. The report made mention of lost drilling fluid (water and biodegradable soap) due to the fractured nature of the first 300 feet and noted little local spring flow. The report indicated that as a consequence, the acquisition of reliable groundwater data was not possible. Based on the loss of drilling fluid the information may suggest the drill sites were located in recharge areas.

Acid and Toxic

Although the Operator indicates no materials will come out of the mine, and no acid and toxic materials were found in the samples obtained in the State Lease, undetected acid and toxic coal zones may affect the operational or post reclamation water quality. Should any spring or water source be recharged or intercepted by mining operations acid and toxic forming materials, if found in the workings, could potentially affect water quality of the springs shown to discharge from the Blackhawk or that may discharge from the portal.

To date, the plan indicates the Operator has intercepted significant flows three times. However, the Operator does receive inflows currently which are used in mine operations. The Operator should discuss potential impacts related to closing of the portal for reclamation and the potential to accumulate water in the current workings. Since the Operator is now mining up-gradient, the relation of mine workings elevation to the elevation of the portal should be discussed in terms of potential to discharge from the portal.

The Operator had committed to provide additional roof and floor samples from three equally spaced locations within the current mine workings (State Lease and Right-of-Way areas). These samples were submitted. Analysis were determined to be non-acid and toxic forming by the Operator. The analysis in soils section Chapter 2, page 2-9, indicates the Applicant has determined the coal to have an acid forming potential. The result of chemical analysis for overburden is stated to be provided on pages 8 and 10 within Appendix 2-3. However, this information could not be located on the referenced pages. The Operator has included a commitment to sample the coal in Section 6.24.33. The locations are identified in: 1st North 1st Right - to be developed the first and second quarter of 1995; Main West First Right - currently developed and to be extended during the first quarter of 1998; and 1st North 9th Left - proposed for finished development and retreat this year. No commitment date for sampling was identified.

Surface Water

The Operator has indicated there is some potential for surface water impacts and that those impacts are expected to be minimal. The Operator states the historical data summarized in the annual report shows no indication of mine related impacts on hydrology of the area. No comparisons or summary of data could be found in the annual reports to support this statement. **R645-301-728.200** states the PHC determination will be based on hydrologic, geologic and other information collected for the permit application. The Operator committed to provide a more detailed summary of the report in the response memo. No description of what will be covered is identified.

Appendix 7-48, "Findings from Supplemental Information on Hydrologic Conditions", should be included in the PHC analysis. The Operator included discussion and reference to the potential increases of sedimentation by subsidence in the PHC. The Operator is considered to have adequately addressed this area.

Deficiency:

1. The proposed method of analysis for acid and toxic constituents is not provided, therefore the Operator does not meet the requirements of **R645-301-120**, and **R645-301-731**. The plan must contain a commitment to monitor materials once a year at a minimum for acid and toxic materials.

R645-301-731.210

Ground Water Monitoring Plan

Discussion:

Seep and spring locations are on Plate 7-12. Tables 7-4 and 7-5 list the parameters for which baseline and operational monitoring are done. Groundwater monitoring will include collection of water quality and quantity data from sixteen springs in the spring of 1994 (pages 7-40 and 7-42). SP2-24, SP2-9, SP-47a, SP2-14, SP2-23, and SP1-3 were chosen because of the water rights filed on them by the USFS. SP-30 and SP-36 will be monitored to determine potential impacts in the immediate vicinity of the mine. SP-58 will be monitored as an indicator of long term changes in groundwater issuing from the Blackhawk Formation in an area that will not be affected by mining operations. SP1-19 and SP1-22 will be monitored as indications of the water supply in the upper reaches of Blind Canyon. SP1-33, SP1-47, and SP2-1 will be monitored for indications of changes in ground water issuing into Joes Valley from near the base of East Mountain. SP1-9 and SP1-24 will be monitored for effects from subsidence in the state leases.

According to Appendix 7-17 and Annual Reports for 1990, 1991, 1992, and 1993, spring SP-30 has had no measurable flow since October 1985. Genwal intends to continue monitoring SP-30 to observe flow trends as they relate to precipitation patterns.

SP-58, SP2-9, SP2-24, SP1-33, and SP1-9 will continue to be monitored quarterly for quantity and quality. Genwal proposes that SP-30, SP2-1, SP1-47, SP1-24, SP-19, SP-47a, SP1-3, and SP2-14, SP2-23, and SP1-22 will be monitored for quantity and other field parameters only. SP-36 has been listed in both groups, so its planned status needs to be clarified.

Genwal has removed SP2-14 and SP2-23 from the list of springs to be monitored based on the assertions that there has been low or no flow over the past few years, mining will not extend under the south fork of Horse Canyon, and a nearby spring, SP 1-9, will continue to be monitored quarterly. Data in Appendix 7-17 show SP2-14 has only been visited a total of three times, was flowing 1 gpm or more each time, 3 gpm at the latest visit in June 1993. SP2-23 had measurable flow as recently as June 1992. The nearest spring is SP 2-9 and not SP 1-9. In June 1993 SP 2-9 was flowing 8 gpm. SP2-14 and SP2-23 are the only seeps or springs monitored in the north fork of Horse Canyon, in an area that is scheduled for full extraction mining in 1998. However the low flows and proximity to SP 2-9, which has apparently greater and more consistent flow and will also be subsided by the same mining sequence, indicate monitoring of these springs may be superfluous. The no subsidence buffer zone in the south fork will have no effect on the areas where these springs are located and referring to it to justify cessation of monitoring makes no sense.

Deficiency

1. SP-36 must be monitored quarterly for quantity and quality.

R645-301-731.220

Surface Water Monitoring Plan

Discussion:

Two flumes have been installed on Crandall Creek, another in Blind Canyon, and another in Indian Creek. Flume locations are shown on Plate 7-16. Stream channel monitoring stations have been established along both the north and south forks of Crandall Creek, Blind Creek, and the south fork of Horse Creek. Water quality samples will be collected from the flume locations quarterly and analyzed according to Tables 7-8 and 7-9. Genwal commits to analyze samples taken during the low-flow period in 1990, 1995, 2000, and every fifth year thereafter according to Table 7-9.

Only no-retreat mining will be conducted beneath the buffer zones along these streams until it has been determined what reaches are perennial and that these reaches will not be adversely affected by mining (page 7-49).

There are no water quality data for Horse Canyon in the proposed plan. Horse Canyon is hydraulically upgradient of the proposed mine. Proposed mine plans indicate no retreat mining will be done beneath the stream or adjacent buffer zones in the LBA lease. Under the currently approved plan, mining has already been done under the south fork of Horse Canyon and Blind Canyon. Retreat-mining has been done beneath the uppermost reaches of Horse Canyon, which were identified as not having perennial flow, and under Blind Canyon.

Blind Canyon is the location of a study, being done by the USFS and partially financed by Genwal, of effects of retreat-mining induced subsidence on watershed erosion and stream flow. The study has the objectives of quantifying changes in stream channel profiles and changes in channel features, such as erosion caused by subsidence from retreat-mining. A timetable for the research and mining is in Appendix 7-26 and related information is in Appendices 7-27 through 7-39. An interim report is due from the USFS by September 1994 and a final report by September 1995.

If streamflows in Blind and Crandall Canyons are affected by mining, Genwal commits to monitor Horse Canyon on a semi-annual basis (page 7-49). Water quality samples will be collected from station H-1 and analyzed according to Table 7-8. Instantaneous flow measurements will be made at stations H-1, HS-1, and HN-1. Monitoring will continue for three years then reevaluated. Because H-1 is on a perennial reach of the stream, monitoring should be done quarterly rather than semi-annually.

Further retreat-mining under the Horse Canyon drainage is not proposed until 1996 (Plate 5-2). Quarterly monitoring of Horse Canyon is to begin Fall 1994. This provides time to characterize baseline conditions in Horse Canyon. Results of the Blind Canyon study or other information may justify modification of the monitoring plan in the future.

R645-301-731.600

Stream Buffer Zones

Discussion:

Section 7.31.6, page 7-52, states portions of the road and sediment pond outslope is within 100 ft of Crandall Creek, a perennial stream. The buffer zone signs designate the area beyond which no disturbance shall take place.

The Operator's description does not accurately detail the buffer zones included in the plan. However, the 100 foot buffer zone along Crandall Creek can be determined from the disturbed area boundary indicated on Plate 7-5A. According to this map a majority of the sediment pond, part of the road, and the west pad area are within 100 horizontal feet of the stream. Additional permit operations include the portable pump, NPDES discharge, and outlet culvert UD-1.

The Operator has referenced page 3-10 and 3-11 which identify how impacts are minimized during construction activities. However, the Operator removed the original approved commitment Number 8 from the reference in pages 3-10 and 3-11 which states, "The Original stream channel will not be altered". The original buffer zone allowance is based on the commitments made previously and should be retained as such unless the Operator receives specific additional buffer zone variances for approved activities by the Division. At this time no changes in the original stream channel have been approved for mining and reclamation activities. The buffer zone information also applies in terms of final reclamation. The Operator should provide a brief discussion on the area within the 100 ft. buffer zone as it relates to contemporaneous reclamation, SAE's and protection from re-disturbance during mining and reclamation activities.

Deficiency:

1. The Operator must retain all of the original commitments as provided by the previously approved buffer zone variance and re-insert commitment Number 8 to the reference in pages 3-9 and 3-10 which states "The original stream channel will not be altered", as this commitment was included to meet the requirement of R645-301-330, **R645-301-731**, and **R645-752.250**. The Operator should also provide a brief discussion on the area within the 100 ft. buffer zone as it relates to contemporaneous reclamation, SAE's and protection from re-disturbance during reclamation activities as is required by **R645-301-342**, **R645-301-731**, and **R645-752.250**.

R645-301-732.200

Sedimentation Pond

Discussion:

Pond Designs

The Operator was requested to include the gravel lining in the bottom of the pond as previously approved in Figure 7-4 A, per the April 14, 1993 deficiency memo.

The Operator has not included the gravel filter liner on the pond Figure 7-4 A. Although Figure 7-4 shows the gravel filter as proposed design, the as-built figure 7-4A and cross sections do not indicate the presence of the gravel. The Operator includes the gravel in the pond volume calculation.

The Operator changed the sediment pond clean out level in the text. The Operator resubmitted 7-4A but has not included the cobble marker. Evidently the cobble marker was never implemented. However, the Operator provides an alternative method to assure the clay liner depth is adequate following pond sediment removal, in text.

Pond Sediment Removal

Section 7.42.22 under Runoff and Sediment Control Facilities, page 7-63 (6/2/94), states that sediment removed from the pond will be initially stored in the location shown on Plate 5-3.

The Operator states permanent disposal of the sediment will be in accordance with Section 5.35. Section 5.35 states there are no permanent refuse sites located on the property and references Section 5.28.30 and Section 7.54.

Section 5.28.30, page 8-3,9 states that sediment pond waste will be: 1) returned to mine workings and disposed in compliance with MSHA regulations; or 2) hauled to a Division licensed coal waste disposal facility. Prior to cleaning samples will be collected and analyzed for acid and toxic forming materials and handled in compliance with the regulations applicable for acid and toxic forming materials. Following receipt of the analytical results and determination of waste volume Genwal will notify and consult with the Division 60 days prior to disposal.

A list of acid or toxic forming constituents or methodologies proposed for testing (a step taken to identify and minimize disturbance) is found on page 5-39A. The Operator also references the parameters in Section 7.31.3 on page 7-52.

The Operator has adequately described the proposed disposal methods for pond waste in Section 5.28.30 and has indicated what acid and toxic constituents would be analyzed for on page 5-39A. The method of analysis was not located although, the Division guidelines are available for testing of acid and toxic constituents.

Pond Sizing

The Operator provides Appendix 7-10 which includes as-built design for the sedimentation pond. In this section the Operator provides a CN of 95 for 1.1 acres paved area. The pond designs provided were developed in 1986. Actual paving and expansion of the road occurred in 1991.

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According to the Division's estimate the paved area draining to the pond is approximately 1.9 acres. This information was derived from Plate 7-5A. The Operator uses a CN of 95 for the paved area.

The Operator referenced the CN for paved roads with open ditches which has a CN of 93. TR 55 indicates that impervious areas (parking lots and roofs etc.) have a CN of 98. The site conditions are a combination of the two situations. Therefore, the Operator's use of CN 95 is within a reasonable range. There still remains a question as to what portions of the site are paved. The Division's determination of paved area based on the presented maps was larger than that submitted by the Operator. Further clarification will occur in a site visit.

It appears the Operator may have omitted the area draining at the east end of the pond located between the pond access road and the natural rock drainage. It must be clearly presented whether this drainage area reports to the pond as per **R645-301-120** and **R645-301-711.300**. Field verification should be conducted as a follow-up.

Reclamation

On page 5-48, revised 6/21/94, the Operator indicates ripping on slopes less than 30% will occur to 18" depth and then be disked. In areas with slopes greater than 30% the subsoil will be ripped to a depth of 18" where practicable. The Operator should also commit to ripping on the contour, where possible, to minimize erosional problems.

Reclamation of Pond

The Operator has committed to remove the pond in Section 5.42.5, page 5-46.

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